EPA/ROD/R03-01/030
2001

EPA Superfund
Record of Decision:

MARINE CORPS COMBAT DEVELOPMENT COMMAND
EPA ID: VA1170024722
OU 05
QUANTICO, VA
10/13/2000

SITE 5 – OLD BATCH PLANT

MARINE CORPS COMBAT DEVELOPMENT COMMAND (MCCDC) QUANTICO, VIRGINIA

RECORD OF DECISION

OCTOBER 2000

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FIGURES

1.0 THE DECLARATION

1.1 SITE NAME AND LOCATION

Marine Corps Combat Development Command
Quantico, Virginia
CERCLIS ID # VA1170024722
Old Batch Plant - Site 5

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedial Action for Site 5 - Old Batch Plant at the Marine Corps Combat Development Command (MCCDC) Quantico, Virginia. This determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for Site 5.

The Commonwealth of Virginia concurs with the selected remedy.

1.3 DESCRIPTION OF THE SELECTED REMEDY

No further CERCLA action is necessary for Site 5 to protect public health, welfare, or the environment, although further confirmatory monitoring will be performed to confirm that no unacceptable current/future risks are posed by exposures to pesticides and polychlorinated biphenyls (PCBs) at the operable unit. One round of sediment sampling for pesticides and PCBs will be performed at three locations (OBPSD002, OBPSD004, and OBPSD006). The results of the analyses will be compared to USEPA Region III Screening levels and if the results are less than their respective screening levels the site will close with No Further Action. If the analytical results of the sediment sampling are greater than USEPA Region III screening levels, a second round of sampling will be conducted and the Navy and regulators will re-evaluate the site.

1.4 STATUTORY DETERMINATIONS

It has been determined that the selected remedy (No Further Action with confirmatory monitoring) for Site 5 is protective of human health and the environment because previous responses at this site have eliminated the need to conduct further remedial action.

This remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure; therefore, a 5-year review will not be required for this remedial action. However, the sediment will be sampled and analyzed in order to ensure that PCB levels in the sediment do not pose unacceptable risks to human health or the environment in the future.

1.5 AUTHORIZING SIGNATURES

The U.S. Navy and the USEPA selected this remedy with the concurrence of the Commonwealth of Virginia Department of Environmental Quality.

Concur and recommended for immediate implementation:

J. F. Cronin
Major General
U.S. Marine Corps Reserve
Commanding General, Marine Corps Base

6 OCT 00
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
USEPA - Region III

10/13/00
Date

2.0 DECISION SUMMARY

2.1 SITE 5 - NAME, LOCATION, AND DESCRIPTION

This Record of Decision (ROD) is issued to describe the Department of the Navy's (Navy) selected remedial action for Site 5 – Old Batch Plant at the MCCDC in Quantico, Virginia (Figures 2-1 and 2-2). Site 5 is one of the Installation Restoration (IR) sites (Figure 2-3) located at the MCCDC facility. The National Superfund database identification number for this site is CERCLIS ID # VA1170024722. The Navy serves as the lead agency with Environmental Restoration, Navy Funding (ER, N) serving as the source of funding.

The Old Batch Plant site (formerly a concrete batch plant) consists of the former location of a concrete pad where thirty-four electrical transformers were stored during the 1970s. The concrete pad was removed when the study area underwent modifications after the Initial Assessment Study (IAS). The area is located within 100 feet (northeast) of Building 3218, near the intersection of Elrod Road and Route 636/ Engineer Road (Figure 2-4). In addition, an ancillary Installation Restoration Program (IRP) site, Building 3218 (B-7), is located southwest of the Old Batch Plant and south of the intersection of Route 636 and Elrod Road.

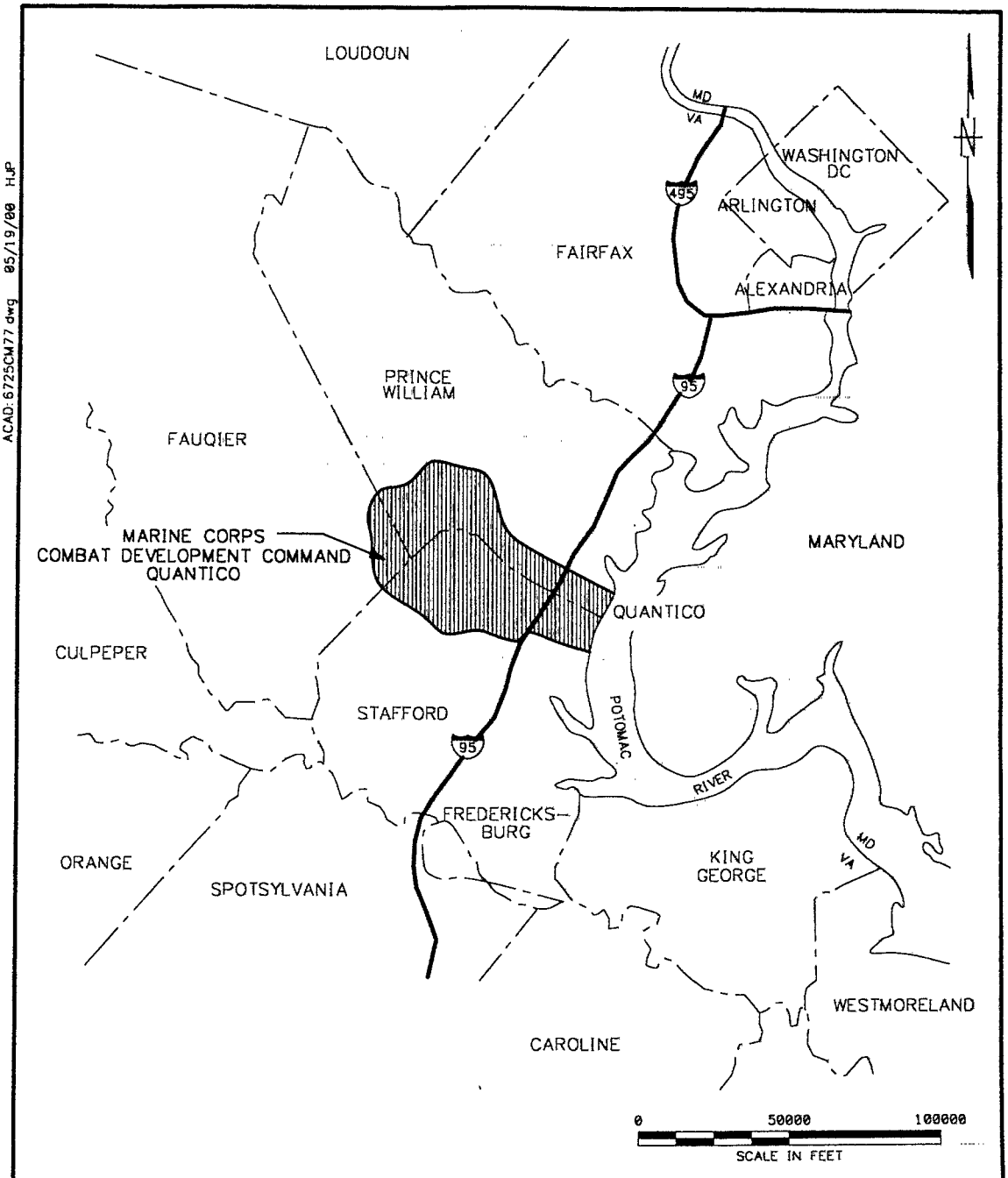
2.2 SITE 5 - HISTORY AND ENFORCEMENT HISTORY

2.2.1 History of Site Activities

Thirty-four electrical transformers were stored at this location on a concrete pad during the 1970's. The transformers originated from the electrical shop. Two of these transformers were reported to have contained 18 gallons each of dielectric fluid containing 100% PCB oil. Twenty-one transformers were found to contain PCBs at less than 100%. The other 11 transformers contained only mineral oil. Site personnel reported that some of the transformers leaked onto the soil. The 34 transformers were taken to the MCCDC Quantico Hazardous Waste Storage Building 2141 in 1979 for temporary storage until picked up by Natural Resources and Training Area Management (NRTAM) for final disposal.

2.2.2 Previous Investigations and Removal Actions

Soil sampling was performed at the Old Batch Plant during the IAS in 1984 and during the confirmation study in 1988 that indicated the presence of PCB contamination. Based on localized elevated levels of PCBs detected in the soils, a removal action was performed at the Old Batch Plant in December 1990. The concrete pad was removed, along with approximately 1 foot of soil from the adjacent areas. Post-excavation sampling of the remaining soil confirmed that residual PCB concentrations were less than the



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CHECKED BY KMS DATE 6/2/00	VICINITY MAP MCCDC QUANTICO, VIRGINIA	APPROVED BY Kelley McGrady DATE 6/2/00	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 2-1	REV. 0

FORM CADD NO. TtNUS_AV.DWG - REV 0 - 1/22/98

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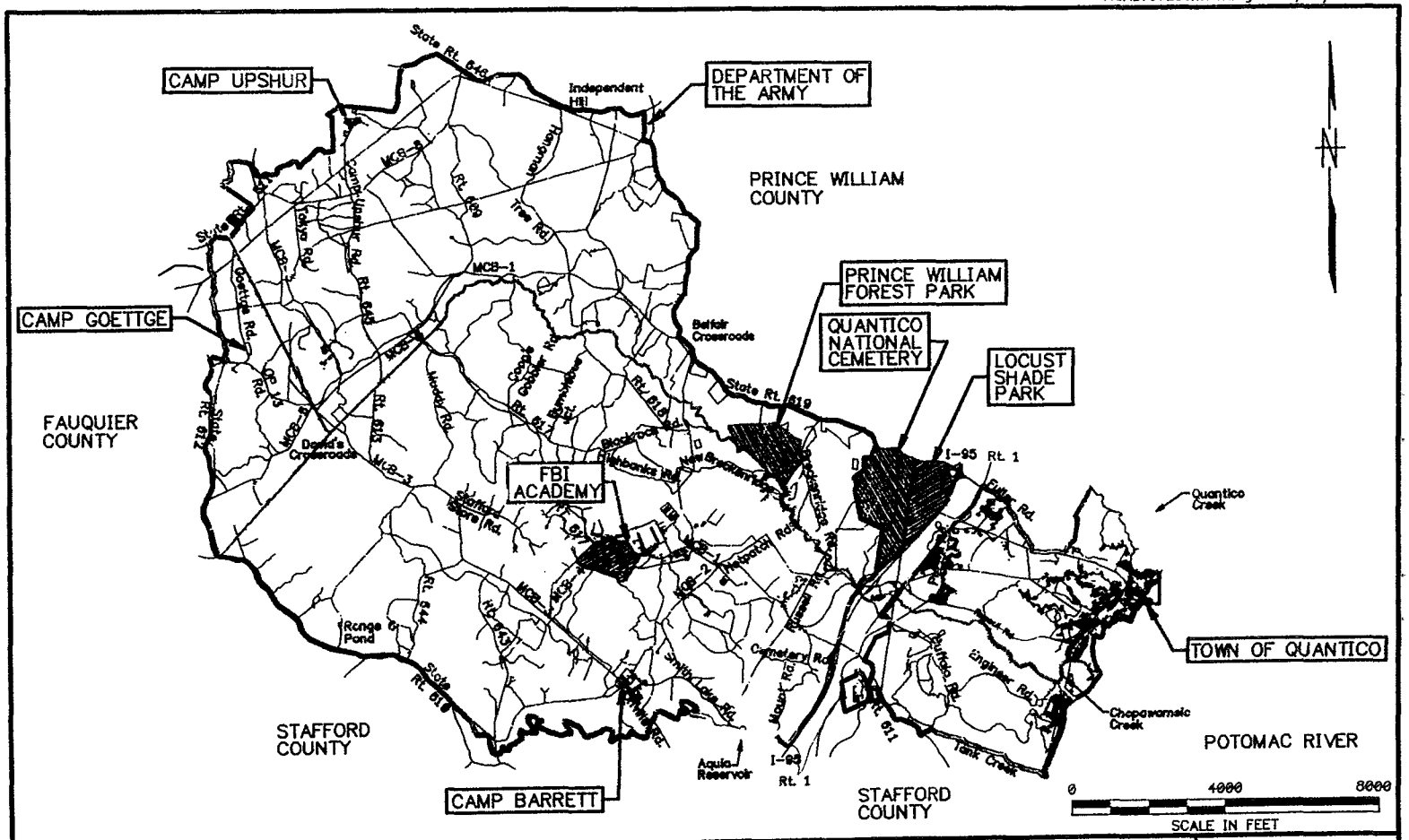

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COST/SCHED–AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 2–2	REV. 0

FORM CADD NO. T+NUS_AH.DWG - REV 0 - 1/22/98

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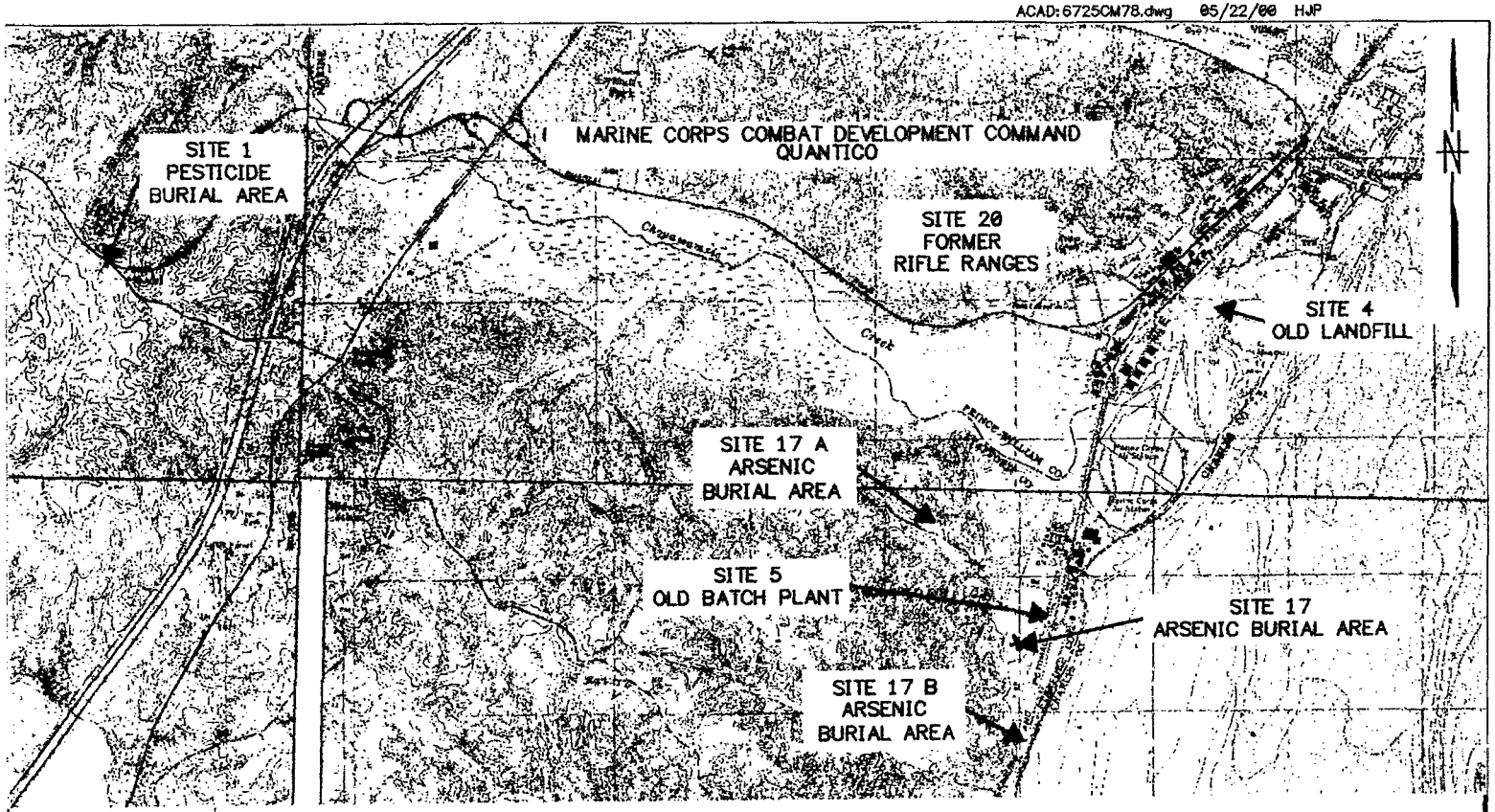

VIRGINIA
QUADRANGLE LOCATION

SOURCE: U.S.G.S QUANDRANGEL MAP OF WHITEWATER,VA.–MD. PHOTOREVISED 1978 BATHYMETRY ADDED 1982; STAFFORD, VA 1966, PHOTOREVISED 1983; QUANTICO, VA.–MD. 1966, PHOTOREVISED 1983, BATHYMETRY ADDED 1982; JOPLIN, VA, PHOTOINSPECTED 1981, 1966, PHOTOREVISED 1971.

0 4000 8000
SCALE IN FEET

DRAWN BY DATE HJP 5/19/00	Tetra Tech NUS, Inc.	CONTRACT NO. 6725	OWNER NO. 0215
CHECKED BY DATE KMS 6/2/00	IR SITE LOCATION MAP MCCDC QUANTICO, VIRGINIA	APPROVED BY Kelley M. Smay DATE 6/2/00	
COST/SCHED–AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 2–3	REV. 0

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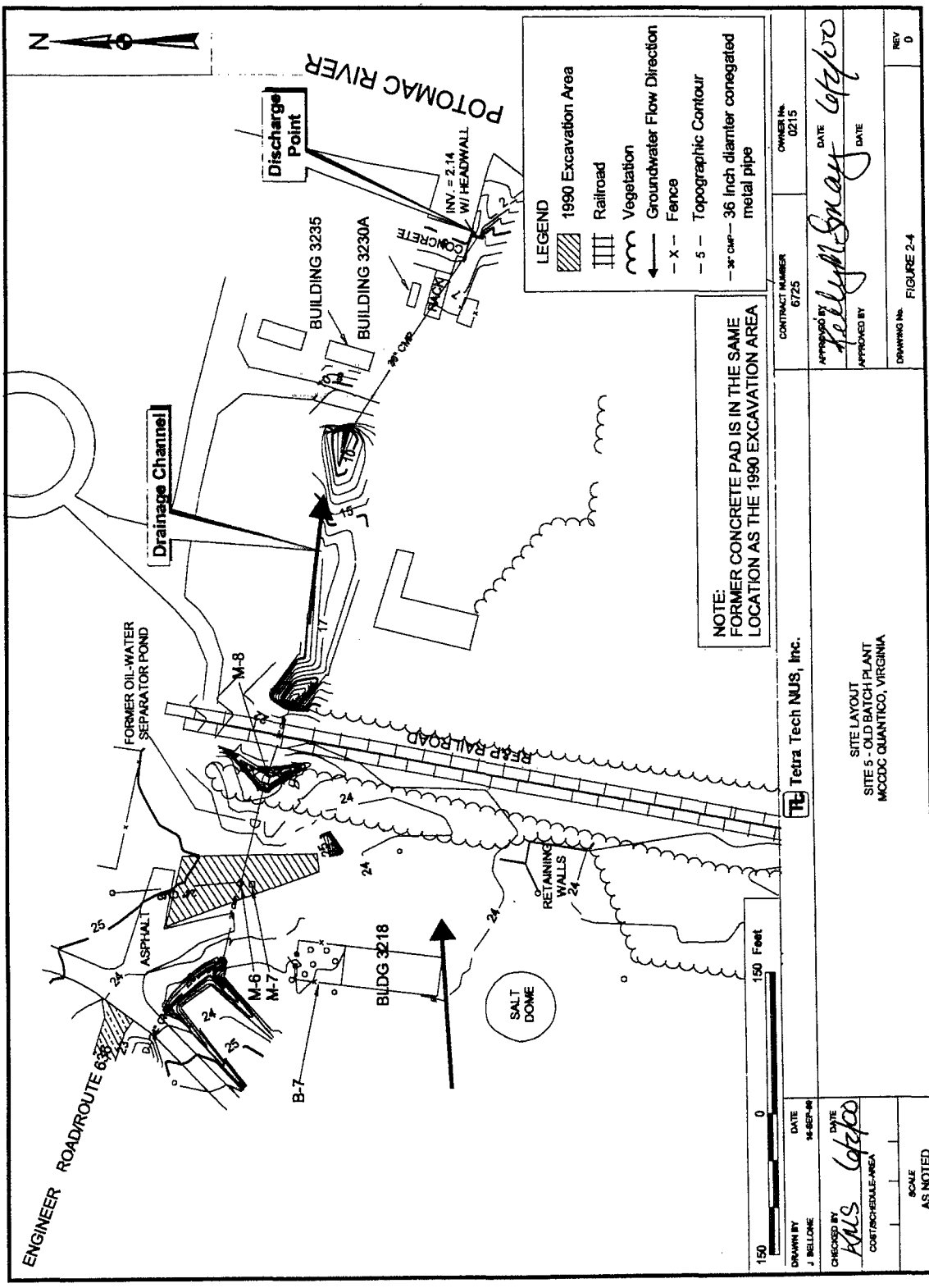

N
POTOMAC RIVER
Discharge Point
INV. = 2.14 W/ HEADWALL
BUILDING 3235
BUILDING 3230A
Drainage Channel
FORMER OIL-WATER SEPARATOR POND
M-8
M-6
M-7
B-7
BLDG 3218
SALT DOME
RETAINING WALLS
REAR RAILROAD
ENGINEER ROAD/ROUTE 638
ASPHALT
LEGEND
1990 Excavation Area
Railroad
Vegetation
Groundwater Flow Direction
Fence
Topographic Contour
36 inch diamter conegated metal pipe
NOTE:
FORMER CONCRETE PAD IS IN THE SAME LOCATION AS THE 1990 EXCAVATION AREA
150 0 150 Feet
Tetra Tech NUS, Inc.
SITE LAYOUT
SITE 5 - OLD BATCH PLANT
MCCDC QUANTICO, VIRGINIA
CONTRACT NUMBER 6725
OWNER No. 0215
DRAWN BY J. BELLOMO
DATE 14-SEP-98
CHECKED BY KLS
DATE 9/25/00
APPROVED BY
DATE
APPROVED BY Kelly M. Gray
DATE 9/25/00
COST/SCHEDULE-AREA
SCALE AS NOTED
DRAWING No. FIGURE 2-4
REV 0
D:\GIS\MCCB_QUANTICO\6725_5701_5702.APR 5/16/00 JCB OLD BATCH PLANT SITE A LAYOUT

target clean-up level of 10 mg/kg. This level was established in accordance with the Toxic Substances Control Act (TSCA) spill cleanup policy. Remedial investigation activities were conducted in 1991 to further characterize site contamination (Radian Corporation, 1992). A PCB removal action report was prepared (Radian Corporation, 1991) and, as a result of the removal action it was expected that a No Further Action (NFA) ROD would be issued. However, based on comments from the U.S. Environmental Protection Agency (USEPA), it was determined that the site needed additional sampling to investigate contamination that may have migrated from the source before it was removed and to verify the source had been adequately removed. Therefore, a Remedial Investigation (RI) was performed at this site.

In addition, the Brown Field Underground Fuel Storage Area (UFSA) is located immediately upgradient of the Old Batch Plant. Groundwater flow across the UFSA is predominantly to the east-southeast towards the Potomac River and in the direction of the Old Batch Plant. Because contamination identified during previous investigations at the UFSA may have impacted groundwater quality at the Old Batch Plant, four stages of investigation (including a site characterization report and corrective action plan) were performed at the Brown Field UFSA between 1989 and 1994. During these investigations, subsurface soil and groundwater contamination were identified that was associated with the past operation of an underground fuel storage system. The field investigation included the installation and sampling of 14 groundwater monitoring wells to define the extent of a groundwater contaminant plume. To date, groundwater contamination consisting of elevated levels of benzene, toluene, xylene, ethyl benzene, and lead have been identified at the Brown Field UFSA site. Contamination identified during previous investigations at the UFSA may impact groundwater quality at the Old Batch Plant; however, these contaminants were not identified in the original Old Batch Plant monitoring well (OBPMW-1) samples collected in November 1991 and May 1992 for the preliminary RI (Radian Corporation, 1992).

2.2.3 Enforcement Actions

No enforcement actions have been taken at Site 5. The Navy has owned this property since 1918 and is identified as the responsible party.

2.3 COMMUNITY PARTICIPATION

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from August 6, 1999 through September 18, 1999 for the proposed remedial action described in the Remedial Investigation and the Proposed Plan for remedial action at Site 5.

These documents were available to the public in the Administrative Record and information repositories maintained at the John Porter Memorial Library, Stafford, Virginia; the Chinn Park Regional Library, Prince William, Virginia; and the Marine Corps Research Center, Quantico, Virginia. Public notice was

provided in the *Potomac News* and the *Free Lance-Star* newspapers on August 5, 1999 and in the *Quantico Sentury* newspaper on August 6, 1999. A public meeting was held at the Quantico Crossroads Inn on Tuesday, August 17, 1999. No written comments were received during the comment period, and no comments were provided during the public meeting.

2.4 SCOPE AND ROLE OF RESPONSE ACTION FOR SITE 5

The remedial action identified in this ROD addresses contamination associated with Site 5 as identified in the initial RI activities report, the final RI report, and the Removal Action Report. The selected remedy is that no further action be taken for soil at Site 5. PCB-contaminated soil was removed from the site; however, the RI was conducted to determine if contamination may have migrated from the source before it was removed and to determine if the source was adequately removed. The post removal action and RI sampling and analysis verified that all soil containing PCB concentrations above the target cleanup levels had been excavated and removed. However, further sampling and analysis will be performed to confirm that no unacceptable current/future risks are posed by exposures to pesticides and polychlorinated biphenyls (PCBs) at the operable unit. One round of sediment sampling for pesticides and PCBs will be performed by the end of 2001 at three locations (OBPSD002, OBPSD004, AND OBPSD006). The results of the analyses will be compared to USEPA Region III Screening levels and if the results are less than their respective screening levels the site will close with No Further Action. If the analytical results of the sediment sampling are greater than USEPA Region III screening levels, a second round of sampling will be conducted and the Navy and regulators will re-evaluate the site.

2.5 SUMMARY OF SITE 5 CHARACTERISTICS

2.5.1 Site Overview

The Old Batch Plant site (formerly a concrete batch plant) consists of the former location of a concrete pad where electrical transformers were stored. The concrete pad was removed when the study area underwent modifications after the Initial Assessment Study (IAS). The area is located within 100 feet (northeast) of Building 3218, near the intersection of Elrod Road and Route 636/ Engineer Road (Figure 2-4).

Other site features include two drop inlets (M-6 and M-7) on the former concrete pad and a separate drop inlet (M-8) downgradient from the site. Similar to culverts, drop inlets are grate-covered ground openings of various sizes. They were meant to catch runoff from the concrete pad and direct it via an underground drainage system into the intermittent creek that flows into the Potomac River. The site is situated on a generally flat area that slopes gently to the west and the east. Surface water from the site flows under the Richmond, Fredricksburg, and Potomac (RF&P) railroad tracks and into the drainage ditch that flows into

the Potomac River. Thirty-four electrical transformers were stored on the concrete pad during the 1970s. In addition, an ancillary Installation Restoration Program (IRP) site, Building 3218 (B-7), is located southwest of the Old Batch Plant and south of the intersection of Route 636 and Elrod Road. The building is a former salt storage bunker that stored de-icing salt in the winter months and has also been used for the storage of off-line transformers.

Site topography is generally flat. Overall, the area slopes gently east-southeast toward the Potomac River. The site lies within the floodplain of the Potomac River, which is located approximately 1,000 feet to the east. Surface water in the area around the site, in the form of stormwater runoff, flows to the east across the site. Runoff from the roads north of the site also potentially flows across the site. Runoff is collected in a drainage ditch aligned along Engineer Road. The ditch channels eastward through a series of culverts, ditches, and drop inlets which ultimately discharge into the Potomac River. Near the Potomac River, the drainage ditch passes by a Base facility.

2.5.2 Remedial Investigation

The RI was completed for Site 5 in 1998 (Tetra Tech NUS, Inc., 1998) to verify the effectiveness of the PCB source removal action and to determine if contamination had migrated from the source before the source was removed. The objective of the RI was to determine the extent of contamination in both surficial and deeper soils and to verify that activity at the site has not impacted groundwater quality or migrated to the surface water and sediment. Field investigation activities consisting of surface/subsurface soil sampling, the installation and sampling of groundwater monitoring wells, and sediment/surface water sampling were completed as part of this effort. This document is summarized below.

2.5.2.1 Description of Contamination

Analytical parameters for the RI sampling were developed on the basis of historical information and previous sampling events (including post-excavation sampling and analysis). Historical information indicated that the Old Batch Plant was used to store electrical transformers and some of these transformers contained PCBs. A target clean-up level of 10 mg/kg for PCBs was developed for the removal action. To confirm the effectiveness of the removal action, two soil borings were completed in 1991 as part of the RI activities. Samples were collected and analyzed for Target Compound List (TCL) pesticides/PCBs. No PCBs were detected in the soil samples. The pesticides 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected at maximum concentrations of 730 µg/kg, 1,200 µg/kg, and 3,300 µg/kg, respectively.

To confirm the elevated detection of pesticides, 13 soil boring locations were sampled in October 1997. Three samples were collected from each boring and field screened utilizing immunoassay field screening

kits for 4,4'-DDT and its metabolites 4,4'-DDD and 4,4'-DDE. Based on the results of the field screening, seven selected samples were then analyzed at an off-site fixed based laboratory for pesticides/PCBs. In addition, five surface soil samples and a duplicate were collected in 1998 from the Ancillary IRP Site B-7 located north of Building 3218 and analyzed for TCL pesticides/PCBs. The maximum concentrations of positively detected chemicals for surface soil samples are shown on Table 2-1 and the frequency of detection and maximum concentrations of positively detected chemicals for subsurface soil samples are shown on Table 2-2.

Groundwater sampling was conducted to further characterize subsurface soil and groundwater conditions. Groundwater beneath the site was generally encountered at depths of 5 feet to 10 feet. Six groundwater samples were collected from one temporary well and one permanent well at Site 5 as well as from four permanent wells installed downgradient of the Brown Field UFSA. The samples were analyzed for TCL pesticides/PCBs. No pesticide or PCB contamination was detected in any of the samples.

Surface water and sediment samples were collected along the drainage ditch to the Potomac River, and surface water samples were collected within the concrete drainage channel and at the discharge point to the Potomac River. The samples were analyzed for TCL pesticides/PCBs. No compounds were detected in the surface water samples above analytical detection limits. The occurrence and maximum detected concentration of chemicals found in the sediment samples are shown in Table 2-3.

RI sampling locations are shown in Figure 2-5.

Selection of Chemicals of Potential Concern (COPCs)

COPCs at the site were selected using USEPA Region III residential and industrial risk-based concentrations (RBCs) and USEPA soil screening levels (SSLs). Compounds at concentrations exceeding residential RBCs were retained as COPCs. In addition, USEPA Region III Biological Technical Assistance Group (BTAG) screening levels were used for comparison to site concentrations of soil and sediment.

TABLE 2-1

MAXIMUM DETECTED CONCENTRATIONS OF CHEMICALS IN SURFACE SOILS SITE 5 – OLD BATCH PLANT MCCDC QUANTICO, VIRGINIA

	Old Batch Plant (µg/kg)	Ancillary IRP Site B-7 (µg/kg)	Risk-Based COPC Screening Level (1) (µg/kg)			
			Residential		Industrial	
Pesticides/PCBs						
4,4'-DDD	60 J	310 J	2700	C	24000	C
4,4'-DDE	190 J	300 J	1900	C	17000	C
4,4'-DDT	230 J	23 J	1900	C	17000	C
Aroclor-1260	220	ND	320 (2)	C	2900(2)	C
Dieldrin	8.4 J	ND	40	C	360	C
Endrin Aldehyde	17 J	ND	2300(3)	N	61000(3)	N
Heptachlor Epoxide	0.44 J	ND	70	C	630	C
Methoxychlor	0.85 J	9.36 J	39000	N	1000000	C

1 USEPA Region III Risk-based Concentration Table, October 1, 1998 (Cancer benchmark value = 1E-6, HQ = 0.1)
2 Value for PCBs used.
3 Value for endrin used.

Definitions:

J Value is considered estimated due to exceedance of technical quality control criteria or because result is less than the Contract Required Quantitation Limit (CRQL).
ND Not detected.
C Carcinogenic
N Non-Carcinogenic

TABLE 2-2

OCCURRENCE AND MAXIMUM DETECTED CONCENTRATIONS OF CHEMICALS IN SUBSURFACE SOILS SITE 5 – OLD BATCH PLANT MCCDC QUANTICO, VIRGINIA

	Frequency of Detection	Maximum Concentration (µg/kg)	Risk-Based COPC Screening Level (1) (µg/kg)			
			Residential		Industrial	
Pesticides/PCBs						
4,4'-DDD	4/4	160	2700	C	24000	C
4,4'-DDE	4/4	150	1900	C	17000	C
4,4'-DDT	4/4	160 J	1900	C	17000	C
Alpha-Chlordane	1/4	0.68 J	1800(2)	C	16000(2)	C
Aroclor-1260	2/4	130 J	320(3)	C	2900(3)	C
Dieldrin	2/4	4.2 J	40	C	360	C
Endosulfan Sulfate	1/4	0.23 J	47000(4)	N	1200000(4)	N
Endrin Aldehyde	1/4	10 J	2300(5)	N	61000(5)	N
Endrin Ketone	1/4	2.4 J	2300(5)	N	61000(5)	N
Methoxychlor	2/4	2.7 J	39000	N	1000000	N

1 USEPA Region III Risk-based Concentration Table, October 1, 1998 (Cancer benchmark value = 1E-6, HQ = 0.1).
2 Value for chlordane used.
3 Value for PCBs used.
4 Value for endosulfan used.
5 Value for endrin used.

Definitions:
J Value is considered estimated due to exceedance of technical quality control criteria or because result is less than Contract Required Quantitation Limit (CRQL).
C Carcinogenic
N Non-Carcinogenic

TABLE 2-3

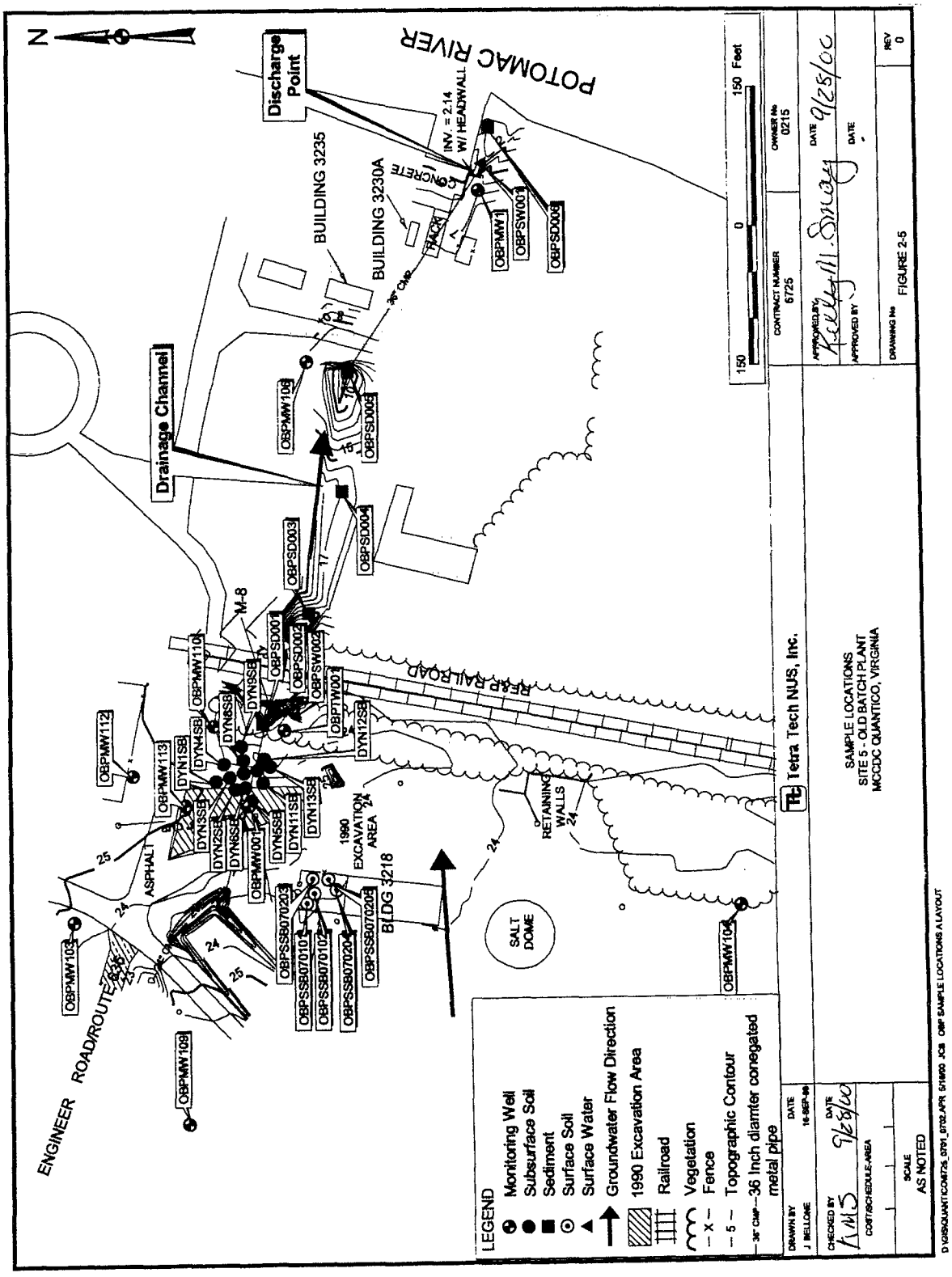
OCCURRENCE AND MAXIMUM DETECTED CONCENTRATIONS OF CHEMICALS DETECTED IN SEDIMENT SITE 5 – OLD BATCH PLANT MCCDC QUANTICO, VIRGINIA

	Frequency of Detection	Maximum Concentration (µg/kg)	USEPA Region III Screening Level (µg/kg)
Pesticides/PCBs			
4,4'-DDD	4/6	77 J	16.0
4,4'-DDE	4/6	57 J	2.2
4,4'-DDT	3/6	33 J	1.58
Aroclor-1260	4/6	250 J	22.7
Dieldrin	1/6	15 J	NA

Definitions:

J Value is considered estimated due to exceedance of technical quality control criteria or because result is less than Contract Required Quantitation Limit (CRQL).

NA None available


N
POTOMAC RIVER
Discharge Point
INV. = 2.14 W/ HEADWALL
CONCRETE
BUILDING 3235
BUILDING 3230A
Drainage Channel
OBPMW109
OBPSD003
OBPSD004
OBPSD001
OBPSD002
OBPSW002
OBPTW001
OBPMW110
OBPMW112
OBPMW113
OBPMW001
OBPMW103
OBPMW108
OBPSW001
OBPSD005
M-8
REAR RAILROAD
ENGINEER ROAD/ROUTE 236
ASPHALT
1990 EXCAVATION AREA
BLDG 3218
SALT DOME
RETAINING WALLS
OBPSS8070201
OBPSS8070202
OBPSS8070203
OBPSS8070204
OBPMW104
150 0 150 Feet
LEGEND
Monitoring Well
Subsurface Soil
Sediment
Surface Soil
Surface Water
Groundwater Flow Direction
1990 Excavation Area
Railroad
Vegetation
Fence
Topographic Contour
36" CMP 36 Inch diameter conegated metal pipe
Tetra Tech NUS, Inc.
SAMPLE LOCATIONS
SITE 5 - OLD BATCH PLANT
MCCDC QUANTICO, VIRGINIA
CONTRACT NUMBER 6725
OWNER No 0215
DRAWN BY J BELLOMO
DATE 16-SEP-98
CHECKED BY
DATE
APPROVED BY
DATE 9/25/00
CONTRACT/SCHEDULE/AREA
SCALE AS NOTED
DRAWING No FIGURE 2-5
REV 0
D:\SRS\QUANTICO\MTGS_0701_0702\APR_5\1600 JCB OBP SAMPLE LOCATIONS A LAYOUT

Surface Soil

The maximum concentrations of all compounds were less than the USEPA Region III RBCs and USEPA SSLs for soil to air. Therefore, no chemicals were retained as COPCs in surface soil for the human health risk assessment at the Old Batch Plant.

4,4'-DDE, 4,4'-DDT, Aroclor-1260 and endrin aldehyde exceeded their respective USEPA Region lll BTAG screening levels and were retained as COPCs for the ecological risk assessment.

Surface/Subsurface Soil

The maximum concentrations of all compounds were less than their respective USEPA Region III RBCs and USEPA SSLs for soil to air. Therefore, no chemicals were retained as COPCs in surface/subsurface soil for the human health risk assessment at the Old Batch Plant area.

Maximum surface/subsurface soil concentrations were also compared to USEPA SSLs for migration to groundwater. The maximum detected concentrations of all chemicals were less than their respective SSLs with the exception of dieldrin. Dieldrin was detected in two soil samples at a maximum concentration of 8.4 µg/kg, which exceeded the SSL of 4 µg/kg.

4,4'-DDE, 4,4'-DDT, 4,4'-DDD and Aroclor-1260 exceeded their respective USEPA Region III BTAG screening levels and were retained as COPCs for the ecological risk assessment.

Groundwater

No chemicals were detected in groundwater samples collected at the Old Batch Plant area. Consequently, no chemicals were retained as COPCs for groundwater.

Surface Water

No chemicals were detected in surface water samples collected at the Old Batch Plant area. Consequently, no chemicals were retained as COPCs for surface water.

Sediment

The maximum concentrations of all compounds were less than their respective USEPA Region III RBCs. Therefore, no chemicals were retained as COPCs in sediment for the human health risk assessment at the Old Batch Plant.

4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aroclor-1260, and dieldrin exceeded their respective USEPA Region III BTAG screening levels and were retained as COPCs for the ecological risk assessment.

2.5.2.2 Contaminant Migration

The data indicate that no significant migration of chemicals from the Old Batch Plan area into the surrounding regions has occurred. Pesticides and Aroclor-1260 were detected in surface and subsurface soil samples and sediments but were not detected in groundwater or surface water samples. Pesticides and Aroclor-1260 will strongly adhere to soil, do not readily leach to groundwater, and are relatively persistent chemicals in the environment. Dieldrin, 4,4'-DDE, 4,4'-DDD and heptachlor are transformation by-products and their presence in soil at the Old Batch Plant area may be due to the degradation of other pesticides. Appendix B contains toxicity profiles for all compounds detected in samples collected at the Old Batch Plan.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The Old Batch Plant is located approximately 100 feet northeast of Building 3218. It is covered with grasses and herbs indicative of old field conditions. Surrounding areas with vegetation are similar in appearance except that more small red cedars are growing in them. Much of the surrounding area is paved, including roads, driveways, and storage areas. The drop inlets and nearby roadside ditches are part of a stormwater system that emerges as a stream from a culvert under the railroad tracks east of the site. This small stream runs through a fairly deep drainage channel (10 to 12 feet below surrounding grade) directly to the Potomac River.

An ancillary IRP site, Building 3218 (Site B-7), is located southwest of the Old Batch Plant and south of the intersection of Route 636 and Elrod Road. The building is a former salt storage bunker used to store de-icing salt in the winter months. The bunker was also used for the storage of off-line PCB transformers.

Site 5 is currently a military land use area and is anticipated to either remain a military land use area in the future or become an industrial or commercial land use area. The mission of the base is currently expanding, and future potential for base closure and conversion to residential land use is considered minimal. Groundwater in the aquifer beneath Site 5 is not a current source of drinking water.

2.7 SUMMARY OF SITE 5 RISKS

The ecological and human health risks associated with exposure to contaminated media at Site 5 were evaluated in the RI Report (Tetra Tech NUS, Inc., 1998). The residential use scenario was evaluated for completeness, although the site is anticipated to remain in industrial use.

2.7.1 Environmental Evaluation

To assess protection of the environment, a screening level ecological risk assessment was performed. The old batch plant is a disturbed area, where electrical transformers were formerly stored, located near the Potomac River. Surface water runoff from the site discharges to a drainage ditch, which channels the water into a series of culverts, ditches, and drop inlets that ultimately discharge to the Potomac River. There is a potential for ecological receptors in or near the river to be exposed to contaminants which migrate from Sites 5 via the surface water run-off pathway. The exposures could originate from sediment and dietary components and, probably to a lesser extent, surface water.

PCBs and pesticides were detected at concentrations exceeding Region III ecological screening criteria for sediment. In addition, there are fish consumption advisories for PCBs in the Potomac River adjacent to the site. However, in 1995, the U.S. Fish and Wildlife Service conducted a caged clam study, which included a study location in the Potomac River at the discharge point from the Old Batch Plant. The study indicated that clams at this location did not accumulate significant concentrations of PCBs or total DDT.

It is unlikely that the PCBs and pesticides detected at Site 5 represent a significant ecological risk beyond the risk present from existing background concentrations. The source of the hazardous substances detected at a site can be considered when determining the risk presented to ecological receptors for purposes of developing a ROD for the site. The transformers at the site have been removed; thus, there is only a relatively small potential secondary source of PCBs (contaminated sediments in the drainage ditch and associated features) to the Potomac River. A Quantico Watershed Study is being developed to assess cumulative impacts on the Potomac River and associated tributaries from multiple sources on the base, including Site 5. Although the focus of the study is much broader than the effects of Site 5 on the watershed, the study may provide further data regarding any risk to the aquatic ecosystem that may be presented by the site contaminants; however, at this time, the likelihood of significant ecological risk is low and does not indicate that action is warranted.

2.7.2 Human Health Risks

Exposure Pathways and Potential Receptors

Potential receptors for the Old Batch Plant area include current/future base personnel, current/future adolescent and adult trespassers, future construction workers, and hypothetical future residents. Current/future off-site or base recreational users are not considered to be potential receptors because swimming, wading, or fishing are not possible due to the intermittent nature of the drainage ditch at the Old Batch Plant area.

Exposure Assessment

Exposure point concentrations are used to determine potential human health risks. Since no COPCs were identified for the Old Batch Plant area, a quantitative exposure assessment was not performed.

2.7.3 Summary, Conclusions, and Recommendations

The following items summarize the major findings for Site 5 – Old Batch Plant, based on the 1992 (Radian Corporation, 1992) and 1998 Rls (Tetra Tech NUS, Inc., 1998) and post-removal action sampling activities.

- Pesticides and PCBs were detected in soil and sediment samples collected at the Old Batch Plant. Although various pesticides and PCBs were detected in the surface soil, the concentrations were all less than 0.31 mg/kg. In addition, no PCBs were detected in the subsurface soil, and none of the pesticides had a concentration higher than 0.16 mg/kg. In the sediment, the only PCB detected was Aroclor-1260 at a maximum concentration of 0.25 mg/kg, and the highest pesticide concentration was 0.077 mg/kg. Pesticides and Aroclor-1260 will strongly adhere to soil, do not readily leach to groundwater, and are relatively persistent chemicals in the environment. No pesticides or PCBs were detected in the surface water or groundwater. Therefore, the data indicate that no significant migration of chemicals has occurred.

- In the ecological risk assessment, 4,4'-DDT and its metabolites (DDTR) were detected in eight surface soil samples; detections of other pesticides and Aroclor-1260 were at the frequency of one or two out of the eight samples. Although maximum DDTR values exceeded screening levels, mean concentrations tend to be similar to the screening levels. Several pesticides and Aroclor-1260 had maximum concentrations in sediment that exceeded screening levels. Risk estimates due to food and water ingestion from simple foodchain modeling indicated that the maximum sediment levels would not harm birds feeding on aquatic organisms. Comparison of mean concentrations to

additional guidelines, considered protective of benthic invertebrates, indicated an overall low level of risk.

- The human health risk assessment considered potential exposures to current/future base personnel, current/future adolescent and adult trespassers, future construction workers, and hypothetical future residents. There were no exceedances of direct contact screening criteria.

It is recommended that the Old Batch Plant receive a No Further Action designation with monitoring of the sediment based on the following information:

1. A removal action was conducted in December 1990 to excavate the source of PCB contamination. The concrete pad and approximately 1 foot of soil from adjacent areas were removed. No PCBs were detected in soil samples that were collected during the 1991 RI activities to confirm the effectiveness of the removal action.

2. Soil and sediment samples collected in the vicinity of the site yielded concentrations of compounds below their respective screening criteria, except for 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Aroclor-1260 dieldrin, and endrin aldehyde which exceeded USEPA Region III BTAG screening levels.

3. It is recommended that one round of sediment sampling for pesticides and PCBs be performed at three locations (OBPSD002, OBPSD004, and OBPSD006). The result of the analyses will be compared to USEPA Region III screening levels and if the results are less than their respective screening levels the site will close with No Further Action. If the analytical results of the sediment sampling are greater than USEPA Region III screening levels a second round of sampling will be conducted and the Navy and regulators will reevaluate the site.

4. No pesticides or PCBs were detected in the surface water or the groundwater samples above their respective analytical detection limits.

5. The human health risk assessment concluded that there were no exceedances of direct contact screening criteria for surface and subsurface soil.

6. The potential for this site to impact ecological receptors is low. Overall risks are low, and given the size of the site (50 by 80 feet), the risk levels are negligible. In addition, due to the small size and intermittent nature of the drainage ditch, further consideration of aquatic impacts is not warranted.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy is the same alternative identified as the recommended alternative in the Proposed Plan, which was presented to the public at the Public Meeting held August 17, 1999.

There are no changes in the ROD to the recommended remedial action alternative from that presented in the Proposed Plan.

3.0 RESPONSIVENESS SUMMARY

3.1 BACKGROUND ON COMMUNITY INVOLVEMENT

The Navy-Marine Corps and MCCDC Quantico have had a comprehensive public involvement program for several years. Beginning in 1994, a Technical Review Committee (TRC) has met approximately once every 2 years to discuss issues related to investigative activities at MCCDC Quantico. The TRC is composed mostly of governmental personnel; however, a few private citizens attend the meetings on occasion.

MCCDC has taken several public surveys involving those people living on the base or nearby to determine whether or not there is a need for a Restoration Advisory Board (RAB). The surveys have consistently indicated that the formation of a RAB was not warranted.

Community relations activities for the final selected remedy include:

- The documents concerning the investigation and analysis at Site 5, as well as a copy of the Proposed Plan, were placed in the information repository at the Marine Corps Research Center, the John Porter Memorial Library, and the Chinn Park Regional Library.

- Newspaper announcements on the availability of the documents and the public comment period/meeting date were placed in the *Potomac News* and the *Free Lance-Star* on August 5, 1999 and the *Quantico Sentry* newspaper on August 6, 1999.

- The Navy established a 45-day public comment period starting August 6, 1999 and ending September 18, 1999 to present the Proposed Plan. No written comments were received during the 45-day public comment period.

- A Public Meeting was held August 17, 1999 to answer any questions concerning the Proposed Plan for Site 5. Approximately 10 people, which consisted of Federal and state government representatives, attended the meeting.

3.2 STAKEHOLDER ISSUES AND LEAD AGENCY RESPONSES

No written comments, concerns, or questions were received by the Navy, USEPA, or the Commonwealth of Virginia during the public comment period from August 6, 1999 to September 18, 1999. A public meeting was held on August 17, 1999 to present the Proposed Plan for Site 5 soils, surface water,

sediments, and groundwater and to answer any questions on the Proposed Plan and on the documents in the information repositories. A period was set aside for formal questions to be recorded by the stenographer. However, no questions were asked and no comments were offered.

3.3 TECHNICAL AND LEGAL ISSUES

There are no technical or legal issues concerning the selected remedial action at this site.

REFERENCES

Radian Corporation, 1991. Final PBC Removal Action Report, Marine Corps Combat Development Command, Quantico, Virginia.

Radian Corporation, 1992. Draft Remedial Investigation/Risk Assessment Report for Old Batch Plant, Marine Corps Combat Development Command, Quantico, Virginia.

USFWS (U.S. Fish and Wildlife Service), 1996. Bioaccumulation of Organochlorine Contaminants in the Potomac River near the Old Landfill, Marine Corps Combat Development Center, Quantico, Virginia. Publication No. CBFO-C96-04. USFWS, Anapolis, MD. November.

Tetra Tech NUS, Inc., 1998. Final Remedial Investigation Report for Site 1 - Pesticide Burial Area, Site 5 – Old Batch Plant, and Site 17 – Arsenic Burial Area, Marine Corps Combat Development Command, Quantico, Virginia. King of Prussia, Pennsylvania. December.

APPENDIX A

TOXICITY PROFILES

Chlordane

Technical-grade chlordane is a mixture of structurally related compounds including trans-chlordane, cis-chlordane, -chlordane, heptachlor, and trans-nonachlor. Chlordane was used extensively as a pesticide in the United States from 1948 to 1988. Exposure can still occur from breathing the air of treated homes, consuming shellfish caught in contaminated waters, or eating food produced on contaminated farmlands because the chemical is persistent in the environment. Chlordane is readily absorbed after oral, inhalation, or dermal exposure and is stored in adipose tissue.

Nonlethal accidental poisoning of children by chlordane has resulted in convulsions, excitability, loss of coordination, dyspnea, and tachycardia; however, recovery was complete. When a municipal water supply was contaminated with chlordane in concentrations of up to 1.2 g/L, 13 persons had symptoms of gastrointestinal and neurological disorders. Signs of toxicity from chronic inhalation exposure in chlordane treated homes include sinusitis, bronchitis, dermatitis, neuritis, migraine, gastrointestinal distress, fatigue, memory deficits, personality changes, decreased attention span, numbness or paresthesias, disorientation, loss of coordination, dry eyes, and seizures. Blood dyscrasias, including production defects and thrombocytopenic purpura, have been described for both professional applicators and for home owners and their families following home termite treatment. An inhalation reference concentration (RfC) for chlordane is under review by EPA.

Liver enlargement occurred in mice exposed to 10 mg/m^3 8 hours/day, 5 days/week for 90 days. Increased liver and kidney weights occurred in rats, and serum chemistry changes indicative of liver damage and hypersensitivity occurred in males and female rats exposed to chlordane by inhalation.

Long-term feeding studies with chlordane in laboratory animals resulted in significantly reduced weight gains in male and female rats, a dose-related trend in mortality of rats and mice, and liver hypertrophy of rats. A chronic oral reference dose (RfD) of 5E-04 mg/kg/day for chlordane was calculated from a no-observed-adverse-effect level (NOAEL) from a chronic feeding study with mice.

Exposure of humans from chlordane treated homes has been associated with leukemia, skin neoplasms, and neuroblastoma in children. An increased risk of non-Hodgkin's lymphoma has been found among farmers exposed to chlordane 20 or more days per year.

Hepatic carcinomas and hepatocellular adenomas have been described for several strains of male and female mice and male rats given chlordane in the diet. EPA has classified chlordane as group B2, probable human carcinogen. The carcinogenicity slope factor for oral exposure is 0.35 $(mg/kg/day)^{-1}$ based on an increase of hepatocellular carcinomas in mice and hepatocellular adenomas in rats.

DDT, DDE, and DDD

Exposure to DDT, DDE, and DDD happens mostly from eating contaminated foods such as root and leafy vegetables, meat, fish, and poultry. At high levels, it can damage the nervous system, causing excitability, tremors, and seizures in people. These chemicals have been found in at least 337 of 1,416 National Priorities List sites identified by the USEPA.

DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane) was a manufactured chemical widely used to control insects on agricultural crops and insects that carry diseases like malaria and typhus. It does not occur naturally in the environment. DDT is a white, crystalline solid with no odor or taste. Because of damage to wildlife and the potential harm to human health, the use of DDT was banned in the United States, except for public health emergencies. DDT is still used in some other countries.

Two similar chemicals that result from DDT breakdown and can contaminate the environment are DDE (1,1-dichloro-2,2-bis(chlorophenyl) ethylene) and DDD (1,1-dichloro-2,2-bis(p-chlorophenyl) ethane). DDD was also used to kill pests, but its use has been banned. One form of it has been used medically to treat cancer of the adrenal gland. DDE has no commercial use.

DDT entered the environment when it was used as an insecticide. DDT in air lasts for only a short time. Half the DDT in air is gone within 2 days. It does not dissolve easily in water. DDT sticks strongly to soil particles and does not move quickly to underground water. DDT lasts a very long time in soil; half the DDT in soil will break down in 2 to 15 years. Some DDT will evaporate from soil and surface water into the air, and some will break down by sunlight or by microorganisms in soil or surface water. DDT in soil usually breaks down to form DDE or DDD. Levels of DDT build up in plants and in the fatty tissues of fish, birds, and animals.

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. People who worked with DDT for a long time had some reversible changes in the levels of liver enzymes.

In animals, short-term exposure to large amounts of DDT in food affected the nervous system. In animals, long-term exposure to DDT affected the liver. Animal studies suggest that short-term exposure to DDT in food may have a harmful effect on reproduction.

The Department of Health and Human Services (DHHS) has determined that DDT may reasonably be anticipated to be a human carcinogen. DHHS has not classified DDE and DDD, but the USEPA has determined that they are probable human carcinogens. Liver cancer has been seen in animals that were fed DDT. Studies in DDT-exposed workers did not show increases in cancer.

Aroclor-1260

Aroclor-1260 is a PCB mixture containing approximately 38% C12H4CI6, 41% C12H3CI7, 8% C12H2CI8, and 12% C12H5CI5 with an average chlorine content of 60%. PCBs are inert and are thermally and physically stable; they have dielectric properties.

In the environment, the behavior of PCB mixtures is directly correlated to the degree of chlorination. Aroclor is strongly sorbed to soil and remains immobile when leached with water; however, the mixture is highly mobile in the presence of organic solvents. PCBs are resistant to chemical degradation by oxidation or hydrolysis. However, biodegradation, especially of lower chlorinated PCBs, can occur. PCBs have high bioconcentration factors, and due to lipophilicity, especially of highly chlorinated congeners, tend to accumulate in the fat of fish, birds, mammals, and humans. The use of PCBs in the United States was limited to closed systems in 1974, and in February, 1977 the USEPA issued final regulations prohibiting PCB discharge into waterways.

PCBs are absorbed after oral, inhalation, or dermal exposure and are stored in adipose tissue. Accidental human poisonings and data from occupational exposure to PCBs suggest initial dermal and mucosal disturbances followed by systemic effects that may manifest themselves several years post-exposure. Initial effects are enlargement and hypersecretion of the Meibomian gland of the eye, swelling of the eyelids, pigmentation of the fingernails and mucous membranes, fatigue, and nausea. These effects were followed by hyperkeratosis, darkening of the skin, acneform eruptions, edema of the arms and legs, neurological symptoms, such as headache and limb numbness, and liver disturbance. Hepatotoxicity is a prominent effect of PCBs, including Aroclor-1260, that has been well characterized. Effects include hepatic microsomal enzyme induction, increased serum levels of liver-related enzymes (indicative of hepatocellular damage), liver enlargement, lipid deposition, fibrosis, and necrosis. Chloracne and immune function disorders have been observed in humans and several animal species after PCB exposure. Reproductive and developmental effects, including low-birth weight, decreased gestational time, and decreased reproductive capacity, have been observed in human and animal species. No reference dose (RfDs) or reference concentrations (RfCs) have been verified for Aroclor-1260.

Data are suggestive but not conclusive concerning the carcinogenicity of PCBs in humans. The EPA has not specifically determined a weight-of-evidence classification or slope factor for Aroclor-1260. However, hepatocellular carcinomas in three strains of rats and two strains of mice have led the EPA to classify PCBs as group B2, probable human carcinogen. The carcinogenicity upper-bound slope factor for oral exposure to PCBs is 2.0 $(mg/kg/day)^{-1}$ and the central-estimate slope factor is 1.0 $(mg/kg/day)^{-1}$.

Dieldrin

Exposure to dieldrin happens mostly from eating contaminated foods, such as root crops, fish, or seafood. Dieldrin builds up in the body after years of exposure and can damage the nervous system.

Dieldrin is an insecticide which from 1950 to 1970 was a popular pesticide for crops like corn and cotton. Because of concerns about damage to the environment and the potential harm to human health, EPA banned all uses of dieldrin in 1974 except to control termites. In 1987, EPA banned all uses.

Exposure to dieldrin mainly affects the central nervous system. Ingestion of high levels of dieldrin results in convulsions and death. These levels are many thousands of times higher than the average exposure. Ingesting moderate levels of dieldrin over a longer period may also cause convulsions. The effects of exposure to low levels of dieldrin over a long time are not known. Some workers who made or applied dieldrin had nervous system effects with excitation leading to convulsions. Lesser effects in some workers included headaches, dizziness, vomiting, irritability, and uncontrolled muscle movements. Workers removed from the source of exposure rapidly recovered from most of these effects. The EPA had established an oral RfD of 5E-5 mg/kg-day for dieldrin based on liver lesions in rats from a 2-year study.

There is no direct evidence that dieldrin causes cancer in humans. Studies on workers generally show no increase in cancer or deaths due to cancer. However, mice given high amounts of dieldrin, did develop liver cancers. Dieldrin has been classified as a probable human carcinogen (B2) by the EPA because it caused tumors in rodents when administered orally.

Endrin Aldehyde and Endrin Ketone (as Endrin)

Endrin is a solid, white, almost odorless substance that was used as a pesticide to control insects, rodents, and birds. Endrin has not been produced or sold for general use in the United States since 1986. Little is known about the properties of endrin aldehyde (an impurity and breakdown product of endrin) or endrin ketone (a product of endrin when it is exposed to light).

Endrin does not dissolve very well in water. It has been found in groundwater and surface water at very low levels. It is more likely to cling to the bottom sediments of rivers, lakes, and other bodies of water. The persistence of endrin in the environment depends highly on local conditions. Some estimates indicate that endrin can stay in soil for over 10 years.

Exposure to endrin can cause various harmful effects including death and severe central nervous system (brain and spinal cord) injury. Swallowing large amounts of endrin may cause convulsions and death in a few minutes or hours. Symptoms that may result from endrin poisoning are headaches, dizziness, nervousness, confusion, nausea, vomiting, and convulsions. No long-term health effects have been noted in workers who have been exposed to endrin by breathing or touching it. Studies in animals confirm that endrin's main target is the nervous system. Birth defects, especially abnormal bone formation, have been seen in some animal studies.

In studies using rats, mice, and dogs, endrin did not produce cancer. However, most of these studies did not accurately evaluate the ability of endrin to cause cancer. No significant excess of cancer has been found in exposed factory workers. The USEPA has determined that endrin is not classifiable as to its human carcinogenicity because there is not enough information to allow classification.

Endosulfan Sulfate (as Endosulfan)

Exposure to endosulfan occurs mainly from eating contaminated food. At very high levels, endosulfan affects the central nervous system. It is not known if endosulfan is hazardous when exposure occurs for a long time at low levels. This chemical has been found in at least 143 of the 1,416 National Priorities List sites identified by the USEPA.

Endosulfan is a cream-to-brown-colored solid in crystals or flake form that smells like turpentine. It is an insecticide used to control insects in grains, tea, fruits, vegetables, tobacco, and cotton. In the United States, endosulfan is applied mainly to tobacco and fruit crops. It is also used as a wood preservative. Endosulfan is sold as a mixture of two different forms of the same chemical (alpha- and beta-endosulfan). It has not been produced in the United States since 1982; however, it is still used here to produce other chemicals.

Endosulfan enters the environment primarily through spraying on farm crops. It does not dissolve easily in water. In soil, some endosulfan evaporates into air and some breaks down. It may stay in soil for several years before it all breaks down. It may accumulate in the bodies of fish and other organisms that live in endosulfan-contaminated water.

Endosulfan affects the central nervous system. Accidental ingestion and breathing of high levels of endosulfan result in convulsions and death. Hyperactivity, tremors, decreased respiration, and salivation have also been noted in people who ingested high levels of it. These levels are many thousands of times higher than the average exposure. The effects from long-term exposure to low levels of endosulfan are not known.

Animal studies have shown effects on the kidneys, testes, developing fetus, and liver from longer-term exposure to low levels of endosulfan. The ability of animals to fight infection was also lowered.

The Department of Health and Human Services has not classified endosulfan as to its human carcinogenicity. The International Agency for Research on Cancer and USEPA have also not classified endosulfan as to its potential for human carcinogenicity. Animal studies have not shown that endosulfan causes cancer, and no studies in people are available.

Heptachlor Epoxide

Heptachlor epoxide, an oxidation product of the cyclodiene insecticide heptachlor, is not produced commercially in the United States and is not known to occur naturally. In the environment, heptachlor is converted to the epoxide, a chemical that degrades more slowly and, as a result, is more persistent than heptachlor. Both compounds adsorb strongly to sediments and are bioconcentrated in terrestrial and aquatic organisms; biomagnification of both is significant. Heptachlor epoxide has been identified in at least 87 of the 1,300 hazardous waste sites on the USEPA's National Priorities List.

In the body, heptachlor epoxide is formed by epoxidation of heptachlor. It is distributed to various tissues, with highest levels occurring in adipose tissues, where it may persist for prolonged periods. Heptachlor epoxide has been found in human fat, milk, and also in blood and fat of stillborn infants, indicating transplacental transfer to the fetus.

No studies were available regarding the toxic effects in humans after exposure to heptachlor epoxide. In laboratory animals, the liver and central nervous system are the primary target organs for heptachlor epoxide toxicity. Acute oral LD50s for rats, mice, and rabbits range from 39 to 144 mg/kg, indicating moderate acute oral toxicity. Hypoactivity, ruffled fur, and increased mortality occurred in mice given a single oral dose of 30 mg/kg of a 25:75 heptachlor/heptachlor epoxide mixture, and muscle spasms in the head and neck region and convulsive seizures were observed in young calves fed 2.5 mg/kg/day of a heptachlor epoxide preparation for 3 days. Increased liver weights were reported In male and female mice fed a diet containing 1 to 10 ppm of a 25:75 heptachlor/heptachlor epoxide mixture for 18 months. Increased liver weights were also seen in dogs administered diets containing 0.5 to 7.5 ppm heptachlor epoxide for 60 weeks.

An oral reference dose (RfD) of 1.3E-5 mg/kg/day for subchronic and chronic exposure to heptachlor epoxide was calculated based on a lowest-observed-adverse-effect level (LOAEL) from a 60-week dietary study with dogs. Increased relative liver weight was identified as the critical effect.

No epidemiological studies or case reports addressing the carcinogenicity of heptachlor epoxide in humans were available. Studies with laboratory animals demonstrated that heptachlor epoxide causes liver cancer in mice and rats. Based on USEPA guidelines, heptachlor epoxide was assigned to weight-of-evidence group B2, probable human carcinogen. For oral and inhalation exposure, the slope factor is 9.1 $(mg/kg/day)^{-1}$.

Methoxychlor

Exposure to methoxychlor occurs mainly when workers, farmers, and gardeners use this pesticide. Most people are not regularly exposed to this chemical. In animals, high levels of methoxychlor caused tremors and convulsions and affected fertility. Not much is known about the effects of methoxychlor on human health. This chemical has been found in at least 42 of 1,416 National Priorities List sites identified by the USEPA.

Methoxychlor is a manufactured chemical and does not occur naturally in the environment. It is a pale-yellow powder with a slightly fruity or musty odor. Methoxychlor is used as an insecticide against flies, mosquitoes, cockroaches, chiggers, and a wide variety of other insects. It is used on agricultural crops, livestock, animal feed, grain storage, home gardens, and on pets. Trade names for methoxychlor include DMDT, Marlate, and Metox.

Methoxychlor enters the environment when it is applied to agricultural crops, farm animals, and home gardens as a pesticide. Methoxychlor does not dissolve easily in water. It sticks strongly to soil particles and does not easily evaporate into the air. Methoxychlor breaks down slowly in air, water, and soil by sunlight and microscopic organisms. It may take several months. Levels of methoxychlor can build up in algae, bacteria, snails, clams, and some fish, but it is usually transformed into other substances and rapidly released.

There is very little information about how methoxychlor affects human health. In animals, exposure to very high levels of methoxychlor produced neurologic effects such as tremors, convulsions, and seizures. Because methoxychlor is broken down quickly in the body, humans are unlikely to experience neurologic effects unless exposure to very high levels occurs. Animal studies show that exposure to methoxychlor in food or water harms the ovaries and uterus in females, and the testes and prostate in males. Fertility is decreased in both male and female animals. It is expected that these effects could occur following inhalation or skin contact. Reproductive effects have not been reported in people. The EPA has published an oral reference dose of 5E-3 mg/kg/day for methoxychlor based on excessive lose of litters in rabbit studies.

The International Agency for Research on Cancer has determined that methoxychlor is not classifiable as to its carcinogenicity to humans. Animal and human studies do not provide conclusive evidence about the possible carcinogenicity of methoxychlor.